REMARKS

By this amendment, claims 1-5, 7-15, 17-21 and 32-82 are pending in the application. Of these, claims 44, 47, 50-51, 56-57, 62-63 and 67-68 are being amended and claims 72-82 are being added. The claim amendments and new claims are supported by the originally filed specification and claims, and no new matter is being added. Reconsideration of the present case is respectfully requested.

Allowed and Objected to Claims

Applicants appreciate the Examiner's allowance of claims 1-5, 7-15, 17-21 and 32-43. Applicants also appreciate the Examiner's indication that claims 51, 52, 55, 57, 58, 61, 63, 64, 66 and 68-71 would be allowable if re-written in independent form and including all of the limitations of the base claim and any intervening claim. Claim 70 has been re-written in independent form as claim 80 including all of the limitations of its base claim, and thus this claim is believed to be allowable. Claims 55 and 61 have been re-written in independent form as newly added claims 72 and 76, respectively, including substantially similar limitations as the objected to claims. Thus while claims 72 and 76 and the claims depending therefrom are believed to be allowable, Applicants respectfully request that the Examiner examine the claims de novo.

Rejection Under 35 U.S.C. 102 of Claims 44-49, 53, 54, 56, 59, 60, 62, 65 and 67

The Examiner rejected claims 44-49 under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 5,605,601 to Kawasaki. This rejection is traversed.

Claim 44 is not anticipated by Kawasaki because Kawasaki does not teach "placing a substrate comprising a silicon-containing material having a plurality of dopant concentrations or dopant types in a process chamber; [and] in a first etch step, providing in the process chamber, an energized gas formed from a first process gas comprising [illegible] containing gas and sidewall-passivation

gas, the volumetric flow ratio of the combined volumetric flow rate of the fluorine-containing and chlorine-containing gas to the volumetric flow rate of the sidewall-passivation gas being from about 1:1 to about 10:1, wherein the volumetric flow ratio is selected such that the plurality of dopant concentrations or dopant types in the silicon-containing material are etched at etch rates that vary by less than about 5%," as recited in the claim.

Kawasaki teaches "a titanium silicide film and part of a polysilicon film are anisotropically etched" (abstract.) Thus, Kawasaki teaches etching a titanium silicide film or a polysilicon film, but does not teach placing a substrate comprising a silicon-containing material having a plurality of dopant concentrations or dopant types in a chamber and etching the dopant concentrations or dopant types. Accordingly, claim 44 and the claims depending therefrom are not anticipated by Kwasaki.

Furthermore, claim 44 is not obvious over Kawasaki because Kawasaki does not teach or suggest a process gas suitable for etching a plurality of dopant concentrations or dopant types at etch rates that very by less than about 5%. Kawasaki teaches an "etching selectivity of a silicon oxide film relative to a polysilicon film is approximately one" (column 7, lines 38-40.) However, it is not obvious that a gas mixture that provides a selectivity of a silicon oxide film to a polysilicon film would provide desirable etching of a plurality of dopant concentrations because the silicon oxide film and dopant concentrations or dopant types have different compositions. Accordingly, claim 44 and the claims depending therefrom are patentable over Kawasaki.

Similarly, claim 47 is not anticipated by Kawasaki because Kawasaki does not teach "placing a substrate comprising a silicon-containing material having a plurality of dopant concentrations or dopant types in a process chamber; [and] in a first etching stage, providing in the process chamber, an energized gas formed from a first process gas consisting essentially of a fluorine-containing gas, a chlorine-containing gas and a sidewall-passivation gas [illegible] volumetric flow ratio selected to etch the plurality of dopant

concentrations or dopant types at etch rates that vary by less than about 5%." as recited in the claim. Instead, as discussed above, Kawasaki teaches etching a titanium silicide film or a polysilicon film, but does not teach placing a substrate comprising a silicon-containing material having a plurality of dopant concentrations or dopant types in a chamber and etching the dopant concentrations or dopant types. Accordingly, claim 47 and the claims depending therefrom are not anticipated by Kawasaki.

The Examiner rejected claims 50, 53, 54, 56, 59, 60, 62 and 65 under 35 U.S.C 102(e) as being anticipated by U.S. Patent No. 6,248,252 to Nguyen et al. This rejection is traversed.

Claim 50 is not anticipated by Nguyen et al. because Nguyen et al. does not teach "placing a substrate comprising a silicon-containing material in a process chamber; and etching the silicon-containing material by providing in the process chamber, an energized gas formed from a process gas comprising CF_4, chlorine-containing gas and sidewall-passivation gas," as recited in the claim. Nguyen et al. teaches etching a layer of aluminum-containing material (abstract), but does not teach etching a silicon-containing material. Furthermore, the claim is not obvious over Nguyen et al. because it is not obvious that a mixture of gases suitable for etching an aluminum-containing layer would also be suitable for etching a silicon-containing layer. Accordingly, claim 50 and the claims depending therefrom are patentable over Nguyen et al.

Claim 56 recites "placing a substrate comprising a silicon-containing material in a process chamber; and etching the silicon-containing material by providing in the process chamber, an energized gas formed by coupling RF or microwave energy to a process gas comprising fluorine-containing etching gas, chlorine containing etching gas comprising one or more of Cl_2 and HCl, and sidewall-passivation gas comprising a gas other than the fluorine-containing etching gas," and thus claim 56 and the claims depending therefrom are also not anticipated by Nguyen et al. because Nguyen et al. does not teach etching a silicon-containing material.

Similarly, claim 62 recites "placing a substrate comprising a silicon-containing material in a process chamber; and etching the silicon-containing material by providing in the process chamber, an energized gas formed from a process gas comprising CF_4, Cl_2 and N_2," and thus claim 62 and the claims depending therefrom are not anticipated by Nguyen et al. because Nguyen et al. does not teach etching a silicon-containing layer.

The Examiner rejected claims 50, 53, 54, 56, 59, 60, 62 and 65 under 35 U.S.C 102(b) as being anticipated by U.S. Patent No. 5,609,775 to Liu. This rejection is traversed.

Claim 50 is not anticipated by Liu because Liu does not teach "placing a substrate comprising a silicon-containing material in a process chamber; and etching the silicon-containing material by providing in the process chamber, an energized gas formed from a process gas comprising CF_4, chlorine-containing gas and sidewall-passivation gas," as recited in the claim. Instead, Liu teaches "a method for dry etching a composite metal film, consisting of an aluminum overlay film, a titanium-tungsten film, and a titanium underlay film." (Column 4, lines 33-36.) Thus, Liu teaches etching a composite film, but does not teach etching a silicon-containing material, as in the claim. The claim is furthermore not obvious over Liu because it is not obvious that a gas mixture that is suitable for etching a layer in a composite metal film would also be suitable for etching a silicon-containing layer. Accordingly, claim 50 and the claims depending therefrom are patentable over Liu.

Claim 56 recites "placing a substrate comprising a silicon-containing material in a process chamber; and etching the silicon-containing material by providing in the process chamber, an energized gas formed by coupling RF or microwave energy to a process gas comprising fluorine-containing etching gas, chlorine containing etching gas comprising one or more of Cl_2 and HCl, and sidewall-passivation gas comprising a gas other than the fluorine-containing etching gas," and thus claim 56 and the claims

depending therefrom are also not anticipated by Liu because Liu does not teach etching a silicon-containing material.

Similarly, claim 62 recites "placing a substrate comprising a silicon-containing material in a process chamber; and etching the silicon-containing material by providing in the process chamber, an energized gas formed from a process gas comprising CF_4, Cl_2 and N_2," and thus claim 62 and the claims depending therefrom are not anticipated by Liu because Liu does not teach etching a silicon-containing layer.

The Examiner rejected claim 67 under 35 U.S.C 102(e) as being anticipated by U.S. Patent No. 6,083,841 to Yano et al. This rejection is traversed.

Claim 67 is not anticipated by Yano et al. because Yano et al. does not teach "placing a substrate comprising a silicon-containing material in a process chamber; and etching the silicon-containing material by providing in the process chamber, an energized gas formed from a process gas consisting essentially of CF_4, Cl_2 and N_2," as recited in the claim. Instead, Yano et al. teaches that "Ti film 3 is then etched by an RIE process utilizing the patterned photoresist layer 4 as a mask" (column 4, lines 25-26.) Thus, Yano et al. teaches etching a titanium film, but does not teach etching a silicon-containing material. The claim is furthermore not obvious over Yano et al. because it is not obvious that a gas mixture suitable for etching a titanium film would also be suitable for etching a silicon-containing layer. Accordingly, claim 67 and the claims depending therefrom are patentable over Yano et al.

CONCLUSION

The above-discussed amendments are believed to place the present application in condition for allowance. Should the Examiner have any questions regarding the above remarks, the Examiner is requested to telephone Applicant's representative at the number listed below.

Respectfully submitted,

JANAH & ASSOCIATES
A PROFESSIONAL CORPORATION

Date: 3/10/2002 By: Abigail M. Cotton
Abigail M. Cotton
Reg. No. 52,773

Please direct all telephone calls to:

Ashok K. Janah
(415) 538-1555

Please continue to send correspondence to:

APPLIED MATERIALS, INC.
Patent Department, M/S 2061
P.O. Box 450A
Santa Clara, California 95052

CLIENT/APPLIED.CLCH/1945.P3/AMEND.002

MARKED-UP CLAIMS FOR APPL. NO: 09/507,629

44. (amended) A method of etching a substrate comprising a silicon-containing material having a plurality of dopant concentrations or dopant types, the method comprising:

placing [the] a substrate comprising a silicon-containing material having a plurality of dopant concentrations or dopant types in a process chamber;

in a first etch step, providing in the process chamber, an energized gas formed from a first process gas comprising fluorine-containing gas, chlorine-containing gas and sidewall-passivation gas, the volumetric flow ratio of the combined volumetric flow rate of the fluorine-containing and chlorine-containing gas to the volumetric flow rate of the sidewall-passivation gas being from about 1:1 to about 10:1, wherein the volumetric flow ratio is selected such that the plurality of dopant concentrations or dopant types in the silicon-containing material are etched at etch rates that vary by less than about 5%; and

in a second etch step, providing in the process chamber, an energized gas formed from a second process gas comprising HBr.

47. (amended) A method of etching a substrate comprising a silicon-containing material having a plurality of dopant concentrations or dopant types, the method comprising:

placing [the] a substrate comprising a silicon-containing material having a plurality of dopant concentrations or dopant types in a process chamber;

in a first etching stage, providing in the process chamber, an energized gas formed from a first process gas consisting essentially of a fluorine-containing gas, a chlorine-containing gas and a sidewall-passivation gas in a volumetric flow ratio selected to etch the plurality of dopant concentrations or dopant types at etch rates that vary by less than about 5%; and

in a second etching stage, providing in the process chamber, an energized gas for [illegible] process gas comprising HBr, Br_2 or CH_3Br.

50. (amended) A substrate etching method comprising;

placing [the] a substrate comprising a silicon-containing material in a process chamber; and

etching the silicon-containing material by providing in the process chamber, an energized gas formed from a process gas comprising CF_4, chlorine-containing gas and sidewall-passivation gas.

51. (amended) A method according to claim 50 wherein the [substrate comprises a] silicon-containing material [comprising] comprises a plurality of dopant concentrations or dopant types, and wherein the volumetric flow ratio of the CF_4, chlorine-containing gas, and sidewall-passivation gas is selected to etch the plurality of dopant concentrations or dopant types at etch rates that vary by less than about 5%.

56. (amended) A substrate etching method comprising:

placing [the] a substrate comprising a silicon-containing material in a process chamber; and

etching the silicon-containing material by providing in the process chamber, an energized gas formed by coupling RF or microwave energy to a process gas comprising fluorine-containing etching gas, chlorine containing etching gas comprising one or more of Cl_2 and HCl, and sidewall-passivation gas comprising a gas other than the fluorine-containing etching gas.

57. (amended) A method according to claim 56 wherein the [substrate comprises a] silicon-containing material [comprising] comprises a plurality of dopant concentrations or dopant types, and wherein the volumetric flow ratio of the fluorine-containing etching gas, chlorine-containing etching gas, and sidewall-passivation gas is selected to etch the plurality of dopant concentrations or dopant types at etch rates that vary by less than about 5%.

62. (amended) A substrate etching method comprising:

placing [the] a substrate comprising a silicon-containing material in a process chamber; and

etching the silicon-containing material by providing in the process chamber, an energized gas formed from a process gas comprising CF_4, Cl_2 and N_2.

63 (amended) A method according to claim 62 wherein the [substrate comprises a] silicon-containing material [comprising] comprises a plurality of dopant concentrations or dopant types, and wherein the volumetric flow ratio of CF_4, Cl_2 and N_2 is selected to etch the plurality of dopant concentrations or dopant types at etch rates that vary by less than about 5%.

67. (amended) A substrate etching method comprising:

placing [the] a substrate comprising a silicon-containing material in a process chamber; and

etching the silicon-containing material by providing in the process chamber, an energized gas formed from a process gas consisting essentially of CF_4, Cl_2 and N_2.

68. (amended) A method according to claim 67 wherein the [substrate comprises a] silicon-containing material [comprising] comprises a plurality of dopant concentrations or dopant types, and wherein the volumetric flow ratio of CF_4, Cl_2 and N_2 is selected to etch the plurality of dopant concentrations or dopant types at etch rates that vary by less than about 5%